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(54) Abstract Title
Communication between "pervasive" computing devices

(57) The term "pervasive" is applied to devices to which processing and communication capabilities have been added, but which are not considered to be traditional computers, e.g. cellular phones, vending machines, traffic lights, parking meters and the like. Such devices are able to generate requests for data and transmit the requests to other devices. A device which holds the requested data will, on receipt of the request, transmit the data to the requesting device, where the data is extracted and stored. The requesting device may be a digital camera which requests data as to its present location, and it may receive this data from an in-vehicle computing device having a global positioning system (GPS). The types of data exchanged may be classified using a system of code identifiers, such that devices may be programmed to identify transmitted data bearing certain codes which are of interest to the device user.

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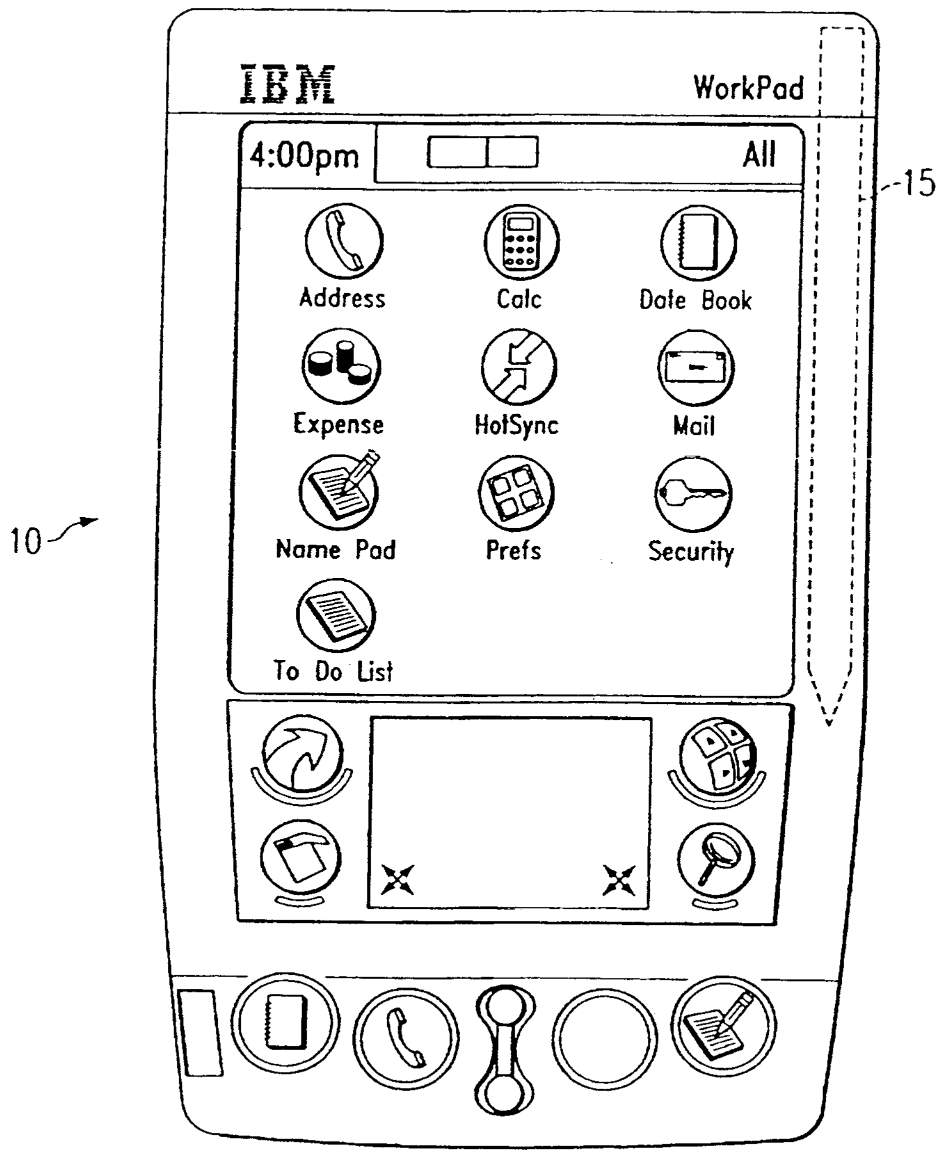
IBM
WorkPad
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15
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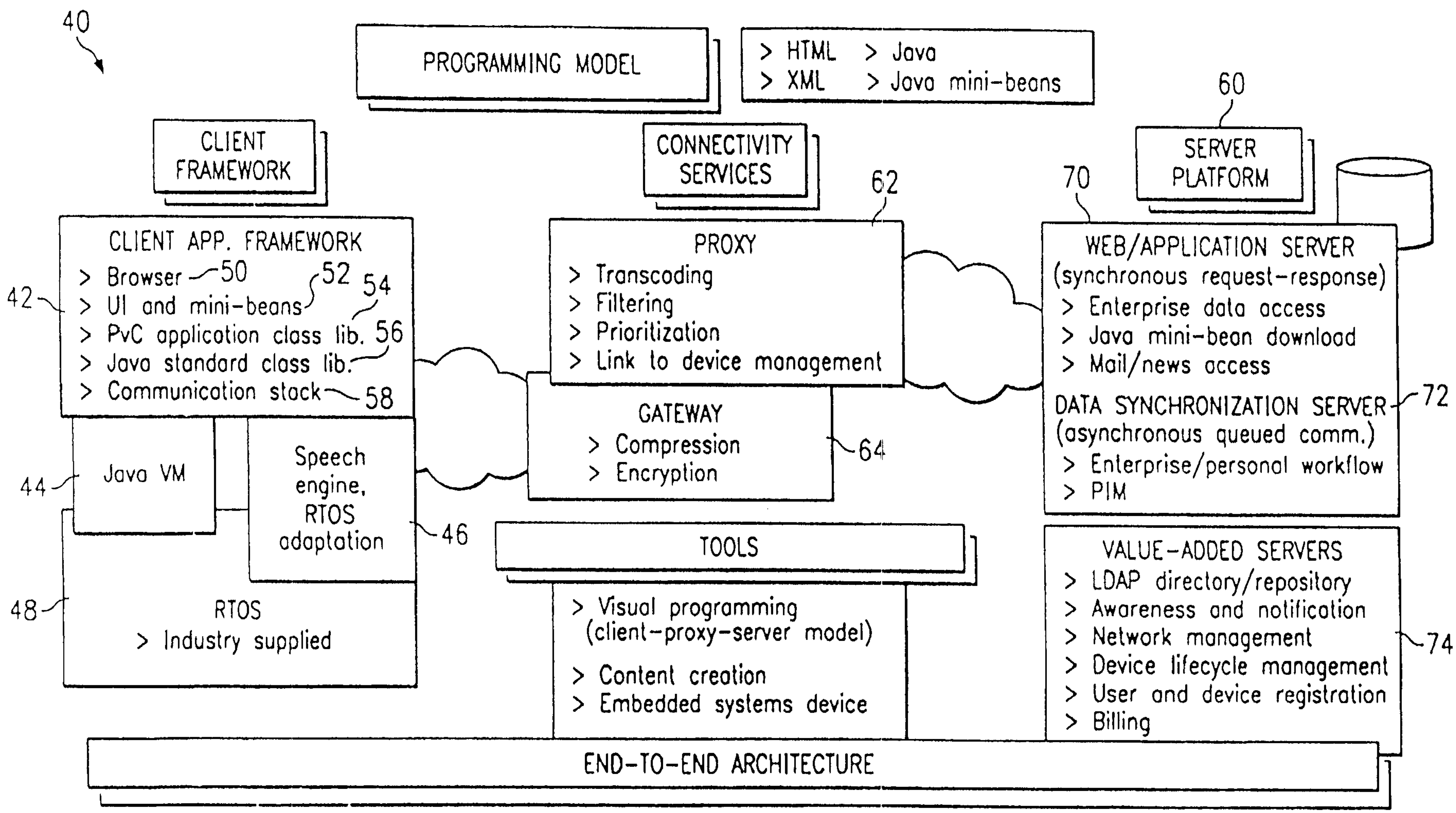
To Do List

FIG. 1


40
PROGRAMMING MODEL
> HTML > Java
> XML > Java mini-beans
CLIENT FRAMEWORK
CONNECTIVITY SERVICES
SERVER PLATFORM
60
62
70
CLIENT APP. FRAMEWORK
> Browser 50
> UI and mini-beans 52
> PvC application class lib. 54
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> Communication stack 58
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Speech engine, RTOS adaptation
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> Filtering
> Prioritization
> Link to device management
GATEWAY
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> Encryption
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TOOLS
> Visual programming (client-proxy-server model)
> Content creation
> Embedded systems device
WEB/APPLICATION SERVER
(synchronous request-response)
> Enterprise data access
> Java mini-bean download
> Mail/news access
DATA SYNCHRONIZATION SERVER
(asynchronous queued comm.)
> Enterprise/personal workflow
> PIM
72
VALUE-ADDED SERVERS
> LDAP directory/repository
> Awareness and notification
> Network management
> Device lifecycle management
> User and device registration
> Billing
74
END-TO-END ARCHITECTURE

FIG. 2

FIG. 3

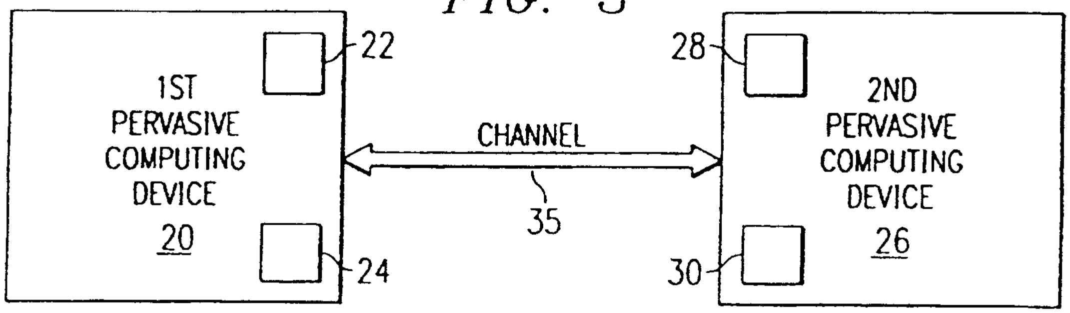
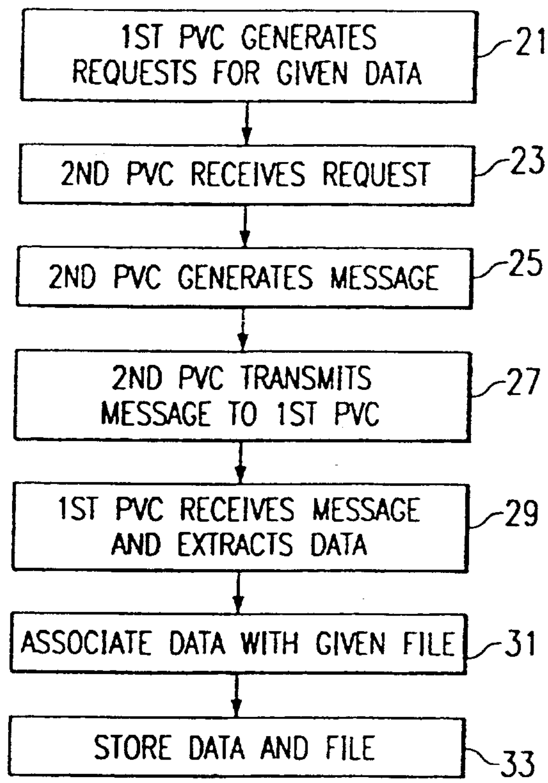


FIG. 4



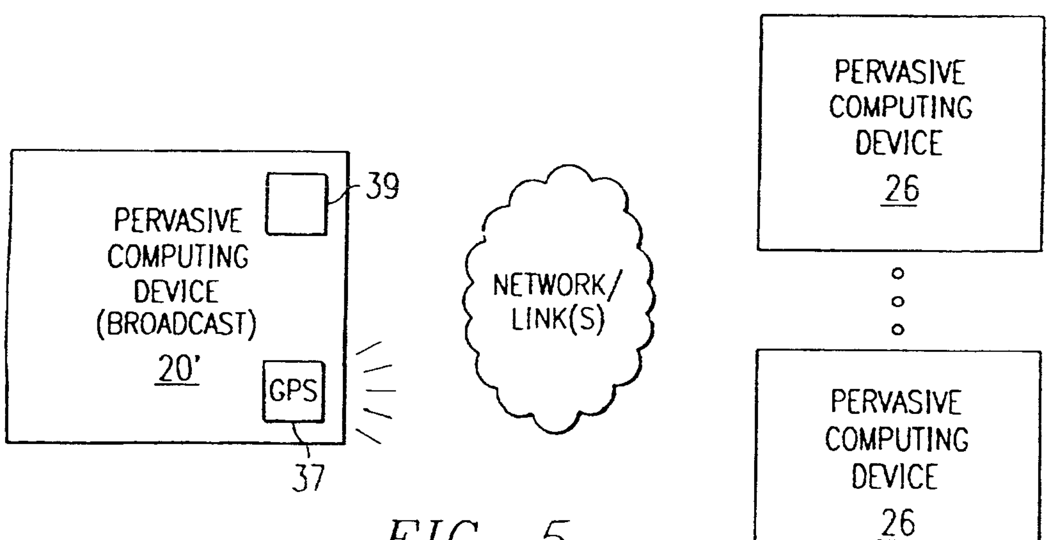


FIG. 5

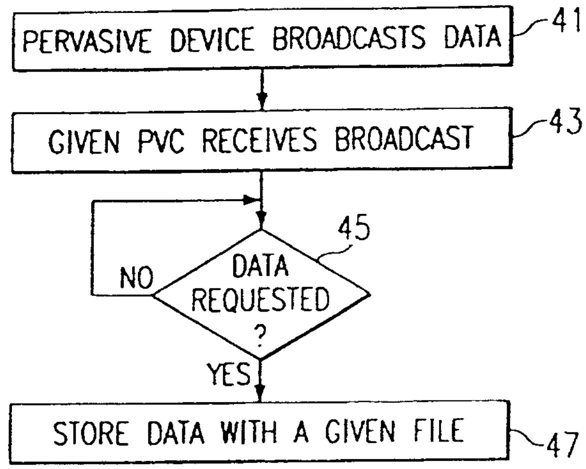


FIG. 6

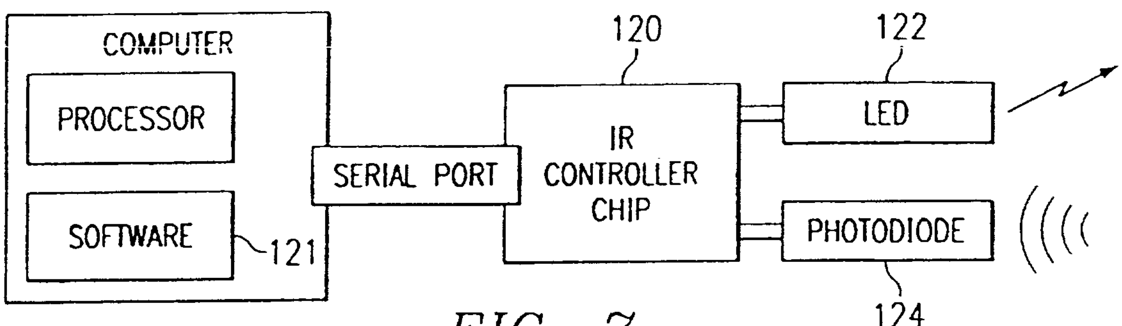
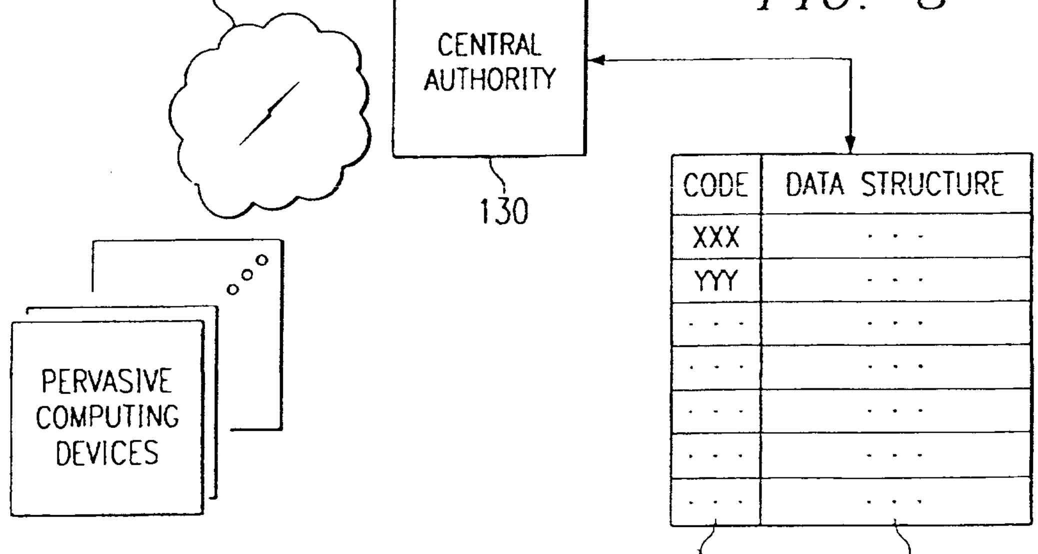


FIG. 7

FIG. 8



METHOD AND SYSTEM FOR ENABLING PERVASIVE COMPUTING DEVICES TO COMMUNICATE WITH EACH OTHER

Technical Field

This invention relates generally to mobile computing devices that have the capability of transmitting and receiving information between themselves.

Description of the Related Art

Recently, the computer industry has sought to add computer processing and communications capabilities to devices other than what would normally be considered a traditional computer. Such devices are quite varied and include, for example, personal digital assistants (PDAs), business organizers (e.g., IBM WorkPad, the 3Com PalmPilot, and the like), smartphones, cellular phones, desktop screen phones, in-vehicle devices, vending machines, kiosks, vehicle traffic lights, parking meters, computer peripherals (such as printers, fax machines, and the like), other handheld devices, and the like. (IBM and WorkPad are trademarks of IBM Corporation and 3Com and PalmPilot are trademarks of 3Com Inc.) For convenience, these devices, as a class, are sometimes referred to as "pervasive computing" clients as they are devices that are designed to be connected to servers in a computer network and used for computing purposes regardless of their location.

A digital camera is a good candidate for a pervasive computing device. Such cameras already include the architecture (e.g., processor and memory) that are required for mobile computing, and these devices already have special capabilities that are desirable. Thus, for example, conventional cameras often use "databacks" to record onto film the date and time that a given picture was taken. Digital cameras could provide this function as well, perhaps in a less disruptive way than in a conventional camera, because such information would not have to be overlaid on the picture itself. Indeed, in a digital camera, there is much additional information that could be attached to or otherwise associated with a given picture were such information available to the camera. Such information might include, for example, an identification of where the picture was taken, a more precise timestamp, or the like. One approach to addressing this need would be to provide a global positioning system (GPS) receiver within the camera. This would allow the user to record the location of where the picture was taken, but it is a costly solution.

As the above example illustrates, as pervasive computing devices become more ubiquitous, it will be desirable to allow such devices to

communicate with each other. Currently, however, there is no convenient way of providing information exchange between devices of this type.

Disclosure of the Invention

The present invention provides a method for communicating given data between a first computing device and a second computing device. The first and second computing devices preferably are pervasive computing devices, each having a processor, memory, an operating system, and input/output devices. In one embodiment, the method begins with the first computing device generating a request for the given data and transmitting the request to the second computing device. According to the method, the first computing device requests the data because it does not have the capability of generating the data itself (or, if it does, the data is not then available to the device). The request for the given data is received at the second computing device, which, if the data is available therefrom, generates a message including the given data. The second computing device then transmits the message back to the requesting device. At the first pervasive device, the given data is extracted and stored with a given file. In one illustrative embodiment, the given data is global position data, the first computing device is a digital camera, and the second computing device is an in-vehicle computer having a global positioning system. The request and response message may be transmitted over a wireless communications channel, such as an infrared link.

According to another feature of the invention, a method is provided for communicating global position data between a first computing device and a second computing device. The method begins with the second computing device, such as an in-vehicle mobile computer, broadcasting a message including global position data identifying the location of the device itself. The message is received at the first computing device. If the global position data is required or otherwise useful to the first computing device, such position data is then stored with a given file, e.g., a digital photograph.

According to still another feature of the present invention, a communications system comprises first and second pervasive computing devices of different types. The first pervasive computing device includes a wireless receiver, and the second pervasive computing includes means for generating given data unavailable to the first pervasive computing device, together with a wireless transmitter. The system further includes a communications channel interconnecting the

to be selectively communicated from the second pervasive computing device to first pervasive computing device. The given data may be global position data and/or a timestamp.

The invention also describes a communications method operative between first and second pervasive computing devices, each of which include a transmitter/receiver. The method begins by exchanging a set of messages between the first and second pervasive computer devices to determine whether the second pervasive computer device has given data unavailable to the first pervasive computer device. If the second pervasive computer device has the given data, the given data is then transmitted, preferably over a wireless link, from the second pervasive computing device to the first pervasive computing device.

Given the differences in the type of information generated by the various types of pervasive devices, the present invention also includes a coding scheme to facilitate data transfer between devices. Each type of information (e.g., global position data, time information, generic character strings, etc.) is provided with a code and an associated data structure. A central authority is provided for regulating and publishing code assignments and data structures for use by participating devices. According to the present invention, a user may program his or her pervasive computing device to search out and respond to given codes. Alternatively, as a user (having a pervasive device) approaches another pervasive computing device, he or she may select a given code to which the user desires their device to respond.

Brief Description of the Drawings

The invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a representative pervasive computing client device;

Figure 2 is a more detailed representation of a pervasive computing client device in which the present invention is implemented;

Figure 3 is a block diagram of a pair of pervasive computing devices that communicate according to one preferred protocol of this invention;

Figure 4 is a flowchart of an illustrative communication protocol according to the present invention;

Figure 5 is a block diagram of an alternative embodiment of the present invention wherein a given pervasive computing client device broadcasts given data to nearby devices;

Figure 6 is a flowchart of an alternate embodiment of the present invention using a pervasive computing device that broadcasts data to surrounding devices;

Figure 7 is a representative wireless infrared communications link; and

Figure 8 is a block diagram illustrating a central authority for use in managing issuance of codes and data structures for use by the participating pervasive devices.

Detailed Description of the Invention

In general, the present invention describes a protocol for enabling a pair of pervasive computing devices to supply each other with data. Preferably, the invention is practised between a pair of pervasive computing devices of different types, although this is not a limitation of the inventive communications protocol. Further, the protocol assumes that one of the pervasive computing devices (or the user thereof) desires or requires given data that is either not available at the device (e.g., because the device does not have the capability to obtain it) or, alternatively, if the device has the capability to obtain the data, such data is not then available when needed. The invention provides a protocol for enabling a requesting device to obtain the desired data from the other pervasive computing client.

Preferably, the inventive protocol is implemented as a software routine in each of a set of pervasive computing devices. The routines cooperate with each other in a communications protocol to enable one of the devices to obtain given data from the other device.

By way of background, Figure 1 illustrates a representative pervasive computing client device 10 such as a personal digital assistant or PDA. The device also includes a handheld stylus 15 for inputting information to the device. A representative device is marketed by the IBM Corporation under the WorkPad trademark. One of ordinary skill, however, will appreciate that the principles of the invention are generally applicable to a pervasive computing client. Representative devices include a pervasive client that is x86-, PowerPC- or RISC-based, that includes a realtime operating system such as WindRiver VXWorks, QSSL QNXNeutrino, or Microsoft Windows CE, and

that may include a Web browser (PowerPC is a trademark of IBM Corporation, VXWorks is a trademark of WindRiver, QNXNeutrino is a trademark of QSSL and Windows is a trademark of Microsoft Corp.).

Referring now to Figure 2, a representative pervasive computing device comprises client stack 40 including a number of components, for example, a client application framework 42, a virtual machine 44, a speech engine 46, and an industry-supplied runtime operating system (RTOS) 48. The client application framework 42 typically includes a browser 50, a user interface 52, a pervasive computing client application class library 54, a standard Java class library 56, and a communication stack 58. The pervasive computing client connects to a server platform 60 via a connectivity service 62.

At its lower level, the connectivity service 62 includes a gateway 64 that provides compression and encryption functions. The upper level of the connectivity service 62 is a proxy 66 that provides several different functions: transcoding, filtering, prioritization and link to device management. Transcoding refers to the translation from one source markup language to another markup language. Transcoding is required because a pervasive computing client normally does not support the full function set of an HTML Windows-based client. In such case, it is necessary to transcode the HTML-based file into a format (e.g., HDML or handheld device markup language) compatible with the pervasive client computing device so that the file may be appropriately rendered on the client.

The server platform 60 may be of several different types. The platform 60 may be a Web/application server 70 (a synchronous request-response type server) or a data synchronization server 72 74 (an asynchronous queued communication type server). The basic functions are each such server type are illustrated. Alternatively, the platform 60 may be a value-added server that provides additional services such as LDAP directory/repository, awareness and notification, network management, device life cycle management, user and device registration, or billing.

The particular server is typically one of a plurality of servers which are accessible by clients, one of which is illustrated by the pervasive computing client having a browser, as previously noted. A representative Web server is an IBM Netfinity server comprising a RISC-based processor, the AIX operating system and a Web server program, such as Netscape Enterprise Server (Netfinity and AIX are trademarks of IBM Corporation).

A representative server also includes a display supporting a graphical user interface (GUI) for management and administration, and an Application Programming Interface (API) that provides extensions to enable application developers to extend and/or customize the core functionality thereof through software programs including Common Gateway Interface (CGI) programs, plug-ins, servlets, active server pages, server side include (SSI) functions or the like.

Typically, a pervasive computing client device communicates with a server via the framework described above. According to the present invention, however, each of a pair of pervasive computing devices is provided with additional circuitry and software for effecting a communications protocol between the devices. To this end, and with reference now to Figure 3, a first pervasive computing device 20 includes a transmitter 22 and a receiver 24. Likewise, second pervasive computing device 26 includes a transmitter 28 and a receiver 30. The transmitter/receiver pair communicate over a communications channel 35. In one embodiment of the present invention, the communications channel is a wireless channel, such as an infrared link. In such case, the transmitter is a light emitting diode and the receiver is a phototransistor.

Figure 4 is a flowchart illustrating a preferred communication protocol. The routine begins at step 21 with the first computing device generating a request for given data and transmitting the request to the second computing device 26. The request is transmitted by transmitter 22. At step 23, the request is received at the second computing device 26. The routine then continues at step 25 with the second computing device 26 generating a message including the required data. At step 27, the second computing device transmit the message to the first computing device. The routine then continues at step 29 with the first computing device receiving the message. At step 31, the given data is associated with a given file in the first computing device. The data and the file are stored at step 33. This completes the processing.

Figure 5 illustrates an alternative embodiment of the invention wherein a given pervasive computing client 20′ for generates given data that is of interest to computing devices 26′ operating in the vicinity of the client 20′. Thus, for example, pervasive computing client 20′ includes a global positioning system (GPS) or differential GPS 37 that generates the location of the device in global coordinates. According to the present invention, the client 20′ includes transmitter 39 for broadcasting the global position data.

Figure 6 is a flowchart of an alternative embodiment of the inventive protocol wherein a given pervasive device broadcasts data that may be of interest to devices that are operating in the vicinity. In this illustrative embodiment, the data broadcast is a global position of the given pervasive device. The routine begins at step 41 with the pervasive device 20' continuously broadcasting a message including global position data. This data identifies the location of the device. At step 43, a given device 26' operating in the vicinity of the pervasive device 20' receives the broadcast message. A test 45 is then done to determine whether a request for the position data exists. If not, the routine cycles. If, however, the position data is requested, the routine continues at step 47 to store the global position data with a given file. This completes the processing.

In one embodiment, a pervasive computing device is an in-vehicle mobile computer. This device broadcasts or selectively transmits GPS data to another pervasive device operating it the vicinity of the in-vehicle mobile computer. In an illustrative example, the other pervasive device is a digital camera having a databack for associating a timestamp with a given digital photograph. According to the present invention, the digital camera receives the GPS data from the in-vehicle device and stores the location data together with a given photographs or set of photographs. This enables the user to record valuable location data together with the timestamp. In an alternative embodiment, the GPS also generates a timestamp that is recorded with the digital photograph.

As noted above, a representative pervasive computing client device of the present invention includes a global positioning system satellite navigation receiver. Recently, such receivers have become readily available on a widespread commercial basis as integrated circuit devices. Such devices provide latitude and longitude data to within a given tenth of a second of arc. When greater accuracy is required, the accuracy of the position measurement is enhanced using differential GPS (or dGPS), a process in which a number of fixed reference points are used. In dGPS, the positions of the reference points are determined with great precision, e.g., using surveying techniques. A GPS is used to obtain the location of a given reference point, and this measurement is compared with known location to generate a correction value that is then used to correct the position of the pervasive device as measured by GPS.

The present invention, however, is not limited to broadcast or transmission of GPS data. According to the invention, the particular type of data (or the actual content thereof) is not a limitation of the inventive protocol.

Figure 7 illustrates a wireless infrared communications link that may be implemented between a pair of pervasive devices. In particular, a given pervasive computing client configured according to the present invention includes an IR controller chip 120 that drives a light emitting diode (LED) 122 and photodiode 124 comprising an IR port set 118. The LED 122 emits IR signals and the photodiode 124 receives IR signals. Thus, when the pervasive device is configured as a broadcast or sending computer, information is broadcast using the LED 122 of the IR port set. When the pervasive device is configured as a receiving computer, the photodiode 124 is used to receive the information broadcast from the sending computer. In particular, the IR controller chip 120 (in a sending computer) receives information signals from the computer processor and uses these signals to modulate the infrared signal output by the LED. Conversely, at a receiving computer, IR signals (modulated with information) and received by the photodiode are processed by the IR controller chip 120 to obtain the information. A representative IR controller chip is an IBM Model 31T1502, which is used with a transceiver module such as a Model IBM 31T1101.

Moreover, although wireless communication between pervasive computing devices is preferred, it should not be taken by way of limitation. Given pervasive computing devices may communicate over wireline connection, and that connection may be secured. Alternatively, given pervasive computing devices may communicate over a shortrange radio link, over a wireless data transmission link (e.g., via CDMA, GSM, TDMA, CDPD, or the like), via ultrasound, or any other known technique.

One of ordinary skill will appreciate that the applications for this invention are as varied as the different types of pervasive computing client devices. The following are some additional representative examples.

A first pervasive computing device is a kiosk and a second pervasive computing device is a digital camera. The kiosk is located at a given physical location (e.g., a scenic overpass) at which a user of the camera desires to take a photograph. Using the present invention, the pervasive computing device in the kiosk broadcasts (or in response to a request provides) information about the scene that is then stored in the user's digital camera. Thus, when the user later reviews the photograph, the information provided by the kiosk may be retrieved and viewed at the same time.

The first pervasive computing device is a kiosk and the second pervasive computing device is a personal digital assistant. In this

example, the kiosk is located in a retail mall and broadcasts a map of the various stores in the mall. The kiosk may also broadcast information about sales or other events occurring at given stores. When the user passes the kiosk (or otherwise requests such information), the map is stored in the user's pervasive computing device and thus may be recalled by the user to assist in navigation.

In another example, the first pervasive computing device is a vending machine that broadcasts or responds to requests for information about the state of inventory or cash receipts within the machine. The second pervasive computing device is a handheld or mobile computer that is carried by a service technician or product vendor. The first device provides information to the second device to obviate service and refill operations that might otherwise be unnecessary.

In another example, the first pervasive computing device is a vehicle traffic light and the second pervasive computing device is an in-vehicle device. As the vehicle approaches the provisioned traffic light, the first pervasive device provides such information as the length of time the user might expect to wait before clearing the intersection, the state of traffic conditions, the latest weather conditions, the time, and the like. Such information may be provided, for example, over a shortrange radio link.

In another example, a parking meter includes a pervasive computing device. After parking the car and paying the meter, the parking meter may download to the PDA a map identifying its current location, together with a clock (or other such representation) to enable the user to readily determine how much time remains on the meter.

The above examples, of course, are merely exemplary. As pervasive computing devices become to be used in different environments, there will numerous applications in which such devices may communicate to exchange information. To facilitate this process, the present invention also envisions the implementation of a coding scheme to facilitate data transfer between devices. Each type of information (e.g., global position data, time information, map information, weather data, generic character strings, etc.) is provided with a code and an associated data structure. Referring now to Figure 8, a central authority 130 is used to manage such information. In particular, central authority 130 regulates and publishes a set of code assignments 132 and data structures 134 for use by participating pervasive computing devices. The code assignments and data structures comprise a database that may be

readily accessed by devices that desire to communicate according to the inventive protocol. The central authority may be conveniently implemented as a Web site operating on the World Wide Web of the Internet. Pervasive computing clients then may access the site and retrieve the codes and data structures. If desired, the central authority may provide such information for a given charge so that the communication protocol may be implemented on a fee basis.

According to the present invention, a user may program his or her pervasive computing device to search out and respond to given codes. Alternatively, as a user (having a pervasive device) approaches another pervasive computing device, he or she may select a given code to which the user desires their device to respond.

Once provisioned devices have access to the given codes and data structures, the individual devices may participate to exchange data between and among themselves. One of ordinary skill in the art will also appreciate that a given device is not required to provide a requesting device all of the data requested. Thus, in certain circumstances, it may be desirable to provide a requesting device with certain data for free but then to charge a fee for additional data. Alternatively, a given device may only broadcast a sample data stream and wait for requests for the entire data set. This latter approach conserves bandwidth. Similar variations in the inventive protocol are, of course, within the teachings of the present invention.

A given pervasive computing client implementing the inventive protocol includes appropriate software for requesting and/or responding to given messages, and for extracting the data of interest to the pervasive device. Such software is executable in a processor, namely, as a set of instructions (program code) in a code module resident in the random access memory of the computer. Until required by the computer, the set of instructions may be stored in another computer memory, for example, in a hard disk drive, or in a removable memory, or downloaded via the Internet or other computer network.

In addition, although the various methods described are conveniently implemented in a general purpose computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the required method steps.

Further, as used herein, a pervasive computing "client" should be broadly construed to mean any computer or component thereof directly or indirectly connected or connectable in any known or

later-developed manner to a computer network, such as the Internet. Of course, a "client" should be broadly construed to mean one who requests or gets the file, and "server" is the entity which downloads the file.

CLAIMS

1. A method for communicating given data between a first computing device and a second computing device, comprising the steps of:

at the first computing device, generating a request for the given data and transmitting such request to the second computing device;

at the second computing device, receiving the request for the given data and generating a message including the given data; and

at the second computing device, transmitting the message to the first computing device.

2. A method as claimed in Claim 1 further including the steps of:

at the first computing device, receiving the message; and storing the given data with a given file.

3. A method as claimed in Claim 2 wherein the given data is identified by a given code and an associated data structure.

4. A method as claimed in Claim 2 wherein the given code and the associated data structure are assigned by a central authority.

5. A method as claimed in Claim 3 wherein the first computing device is a digital camera, and the given file is a digital photograph.

6. A method as claimed in Claim 5 wherein the second computing device is an in-vehicle computer having a global positioning system.

7. A method as claimed in Claim 1 wherein the first computing device transmits the request via a wireless communications channel.

8. A method as claimed in Claim 7 wherein the message is transmitted to the first computing device via a wireless communications channel.

9. A method as claimed in Claim 8 wherein the wireless communications channel is an infrared link.

10. A method as claimed in claim 1 or claim 5 wherein the given data is position data and further comprising the step of:

at the first computing device, receiving the message; and storing the position data with a given file.

11. A method as claimed in Claim 10 wherein the second computing device is an mobile computer having a positioning system.

12. A method as claimed in Claim 11 wherein the first and second computing devices communicate over a wireless channel.

13. A method as claimed in Claim 12 wherein the wireless channel is a shortrange radio link.

14. A method as claimed in Claim 9 wherein the position data further includes a timestamp.

15. A method for communicating given data between a first computing device and a second computing device, comprising the steps of:

at the second computing device, broadcasting a message including at least a portion of the data, a code identifying the data type, and a data structure;

at the first computing device, receiving the message; and

if the first computing device is provisioned to recognize the code and the data structure, storing the data with a given file.

16. A method as claimed in Claim 15 wherein the first computing device is a digital camera and the given file is a digital photograph.

17. A method as claimed in Claim 16 wherein the second computing device is an mobile computer having a global positioning system for generating the global position data.

18. A method as claimed in Claim 15 wherein the first and second computing devices communicate over a wireless channel.

19. A communications system, comprising:

a first pervasive computing device including a wireless receiver;

a second pervasive computing device of a type different from the first pervasive computing device and having means for generating data unavailable to the first pervasive computing device, the second pervasive computing device also having a wireless transmitter; and

a communications channel interconnecting the first and second pervasive computing devices to enable data to be selectively communicated from the second pervasive computing device to first pervasive computing device.

20. A communications system as claimed in Claim 19 wherein the first pervasive computing device is a digital camera and the second pervasive computing device is an in-vehicle mobile computer.

21. A communications system as claimed in Claim 20 wherein the data is global position data.

22. A communications system as claimed in Claim 20 wherein the data includes a timestamp.

23. A communications method operative between first and second pervasive computing devices, each of which include a transmitter/receiver, comprising the steps of:

exchanging a set of messages between the first and second pervasive computer devices to determine whether the second pervasive computer device has given data unavailable to the first pervasive computer device; and

if the second pervasive computer device has the given data, transmitting the given data from the second pervasive computing device to the first pervasive computing device.

24. A communications method as claimed in Claim 23 wherein first and second pervasive computing devices communicate over a wireless link.

25. A communications method as claimed in Claim 23 wherein the first pervasive computing device is a digital camera and the second pervasive computing device is an in-vehicle mobile computer.

26. A communications method as claimed in Claim 25 wherein the data is global position data.

Amendments to the claims have been filed as follows

CLAIMS

1. A method for communicating position data between a digital camera and a computing device, comprising the steps of:

at the digital camera, generating a request for position data and transmitting such request to the computing device;

at the computing device, receiving the request for the position data and generating a message including the position data; and

at the computing device, transmitting the message to the digital camera.

2. A method as claimed in Claim 1 further including the steps of:

at the digital camera, receiving the message; and storing the position data with a digital photograph.

3. A method as claimed in Claim 2 wherein the position data is identified by a given code and an associated data structure.

4. A method as claimed in Claim 3 wherein the given code and the associated data structure are assigned by a central authority.

5. A method as claimed in Claim 4 wherein the computing device is an in-vehicle computer having a global positioning system.

6. A method as claimed in Claim 1 wherein the digital camera transmits the request via a wireless communications channel.

7. A method as claimed in Claim 6 wherein the message is transmitted to the digital camera via a wireless communications channel.

8. A method as claimed in Claim 7 wherein the wireless communications channel is an infrared link.

9. A method as claimed in Claim 8 wherein the computing device is an mobile computer having a positioning system.

10. A method as claimed in Claim 9 wherein the digital camera and the computing device communicate over a wireless channel.

11. A method as claimed in Claim 10 wherein the wireless channel is a shortrange radio link.

12. A method as claimed in Claim 1 wherein the position data further includes a timestamp.

13. A method for communicating given data between a digital camera and a computing device, the computing device being a mobile computer having a global positioning system for generating the global position data, comprising the steps of:

at the computing device, broadcasting a message including at least a portion of the data, a code identifying the data type, and a data structure;

at the digital camera, receiving the message; and

if the digital camera is provisioned to recognize the code and the data structure, storing the data with a digital photograph.

14. A method as claimed in Claim 13 wherein the digital camera and the computing device communicate over a wireless channel.

15. A communications system, comprising:

a digital camera including a wireless receiver;

an in-vehicle mobile computer having means for generating global position data unavailable to the digital camera, the in-vehicle mobile computer also having a wireless transmitter; and

a communications channel interconnecting the digital camera and the in-vehicle mobile computer to enable data to be selectively communicated from the in-vehicle mobile computer to the digital camera.

16. A communications system as claimed in Claim 15 wherein the data includes a timestamp.

17. A communications method operative between a digital camera and an in-vehicle mobile computer, each of which include a transmitter/receiver, comprising the steps of:

exchanging a set of messages between the digital camera and the in-vehicle mobile computer to determine whether the in-vehicle mobile computer has global position data unavailable to the digital camera; and

if the in-vehicle mobile computer has the global position data, transmitting the global position data from the in-vehicle mobile computer to the digital camera.

18. A communications method as claimed in Claim 17 wherein the digital camera and the in-vehicle mobile computer communicate over a wireless link.

The Patent Office

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Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

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Other: Online databases: WPI, EPODOC, JAPIO, INSPEC

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	EP 0766096 A2 (SHIMADZU)	
A	US 5838237 (REVELL et al)	
A	US 5786789 (JANKY)	
A	US 5642285 (WOO et al)	
A	US 5506644 (SUZUKI et al)	

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
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